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Button Lockout

Abstract

A system for automatically locking buttons (if inadvertently activated) on hand-held controllers is disclosed. The hand-held controllers include motion sensors, such as a tri-axial accelerometer and a tri-axial gyroscope. The tri-axial accelerometer calculates components of a linear acceleration along three axes: x, y and z. The tri-axial gyroscope calculates components of an angular velocity along the three axes: x, y and z. The motion sensors' readings are fed to an application. The application includes a differentiator module and an analysis module. The differentiator module computes derivatives of the components of the angular velocity to calculate components of an angular acceleration along the three axes. If a magnitude of at least one amongst the components of the linear acceleration or the components of the angular acceleration, monitored by the analysis module, is greater than a respective predetermined threshold(s), an auto-lockout function is enabled in the application. The auto-lockout function disables the buttons on the hand-held controllers for a minimal duration.

Problem statement

While playing a game, such as when using a virtual reality device, a user might be moving hand-held controllers in a frenetic manner. Buttons present on the hand-held controllers, such as flush buttons along the gripping surface of the hand-held controllers, can be accidentally pressed by the user or as a result of inertia during fast movements. Consequently, the user might face a negative experience of accidentally exiting the game in case a button is inadvertently activated (for example, a home button).

The present disclosure proposes a novel solution to overcome these challenges.

System and working

The present disclosure describes a system in which buttons on hand-held controllers are locked in case of accidental press or inadvertent activation.

The system that implements this technology can includes following components:

- An application
- An HMD (Head Mounted Display) device
- The hand-held controllers

The hand-held controllers and the HMD device are communicatively coupled to the application installed on a computing device, which may be part of the HMD or a separate device. The application renders a content onto the HMD device to be viewed by a user. As an example, the system can be a virtual reality system and the application can be a VR (virtual reality) application, rendering a 3D VR content.

The hand-held controllers can include following motion sensors:

- A tri-axial accelerometer
- A tri-axial gyroscope

The tri-axial accelerometer calculates components of a linear acceleration along three axes: x, y and z. The tri-axial gyroscope calculates components of an angular velocity along the three axes: x, y and z. Thus, the tri-axial accelerometer and the tri-axial gyroscope produce motion data in 6 degrees of freedom corresponding to each of the hand-held controllers.

Output of the motion sensors (the tri-axial accelerometer and the tri-axial gyroscope) is received by the application as shown in Figure 1. The application includes a differentiator module and an analysis module. The differentiator module computes derivatives of the components of the angular velocity to calculate components of an angular acceleration along the three axes. The analysis module monitors a magnitude of the components of the linear acceleration and a magnitude of the components of the angular acceleration. If the magnitude of at least one among the components of the linear acceleration or the components of the angular acceleration is greater than a respective predetermined threshold(s), an auto-lockout function is enabled in the application. This may be triggered by a user accidentally pressing a button during high acceleration movements. Also, the acceleration of the controller may cause a force to be applied to sensitive buttons, which the system can register as the button being pressed even when the button is not touched by the user. The auto-lockout function inhibits registering the press of the buttons on the hand-held controllers for up to a minimal duration (e.g. .1, .5, or 1 second). However, the press may not be accidental, and the user may have pressed the buttons intentionally; since the auto-lockout function is enabled only for the minimal duration, the user can press the button again (after the minimal duration) to activate the button.

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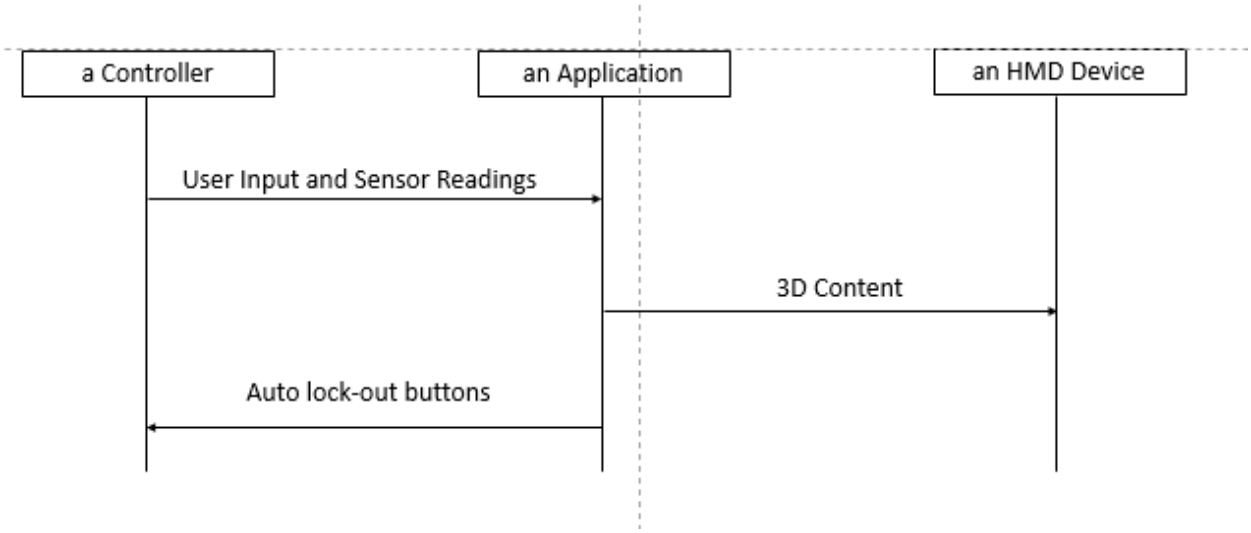

Figure 1: A system with a button auto-lockout feature

Additional embodiments

In an additional embodiment, the hand-held controllers include only one motion sensor i.e. the tri-axial gyroscope. Output of the tri-axial gyroscope is received by the application. The differentiator module of the application computes derivatives of the components of the angular velocity to calculate components of an angular acceleration along the three axes. The analysis module monitors the magnitude of the components of the angular acceleration. If the magnitude of the components of the angular acceleration is greater than the predetermined threshold, the auto-lockout function is enabled in the application. The auto-lockout function inhibits pressing of the buttons on the hand-held controllers for up to the minimal duration. A plot showing a discontinuous line in Figure 2 represents the minimal duration on a time axis for which pressing of the buttons is inhibited. The discontinuous line appears when the magnitude of the components of the angular acceleration (as shown in Figure 2) is greater than the predetermined threshold.

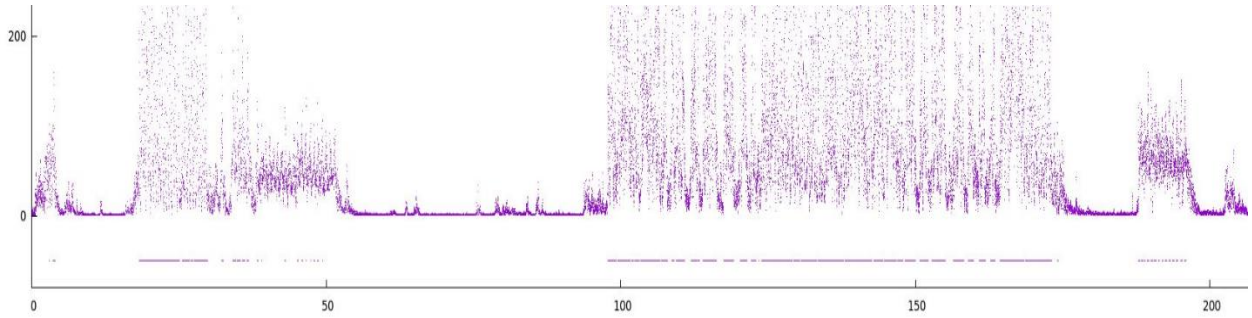

Figure 2: A plot of a magnitude of an angular acceleration over a period of time

Conclusion

Playing games have become quite a norm in today's world. The games often require the user to make fast movements of the hand-held controllers. Sometimes, the buttons on the hand-held controllers are easy to accidently trigger by the user or can be triggered by motion of the controller. It may not be a good experience for the user if s/he accidently presses the buttons. It may lead to annoying interruptions in the ongoing game. With the solution provided in this disclosure; this problem can be mitigated to a great extent. This solution is enabled to inhibit pressing of the buttons for the minimal duration in case the hand-held controllers are in a hyperactive motion.

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